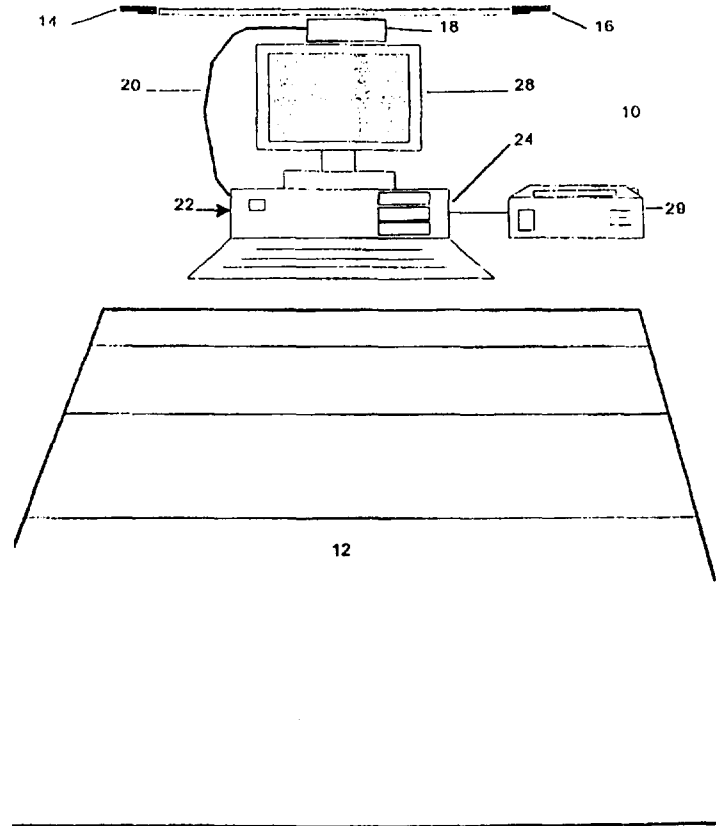


<p>(51) International Patent Classification ⁶ : G01L 3/24</p>	<p>A1</p>	<p>(11) International Publication Number: WO 97/17598 (43) International Publication Date: 15 May 1997 (15.05.97)</p>
<p>(21) International Application Number: PCT/US96/17580 (22) International Filing Date: 5 November 1996 (05.11.96) (30) Priority Data: 08/554,564 6 November 1995 (06.11.95) US (71) Applicant (for all designated States except US): IMPULSE TECHNOLOGY, INC. [US/US]; 30612 Salem Drive, Bay Village, OH 44140 (US). (72) Inventors; and (75) Inventors/Applicants (for US only): FRENCH, Barry, J. [US/US]; 30612 Salem Drive, Bay Village, OH 44140 (US). FERGUSON, Kevin, R. [-/US]; 8338 Shorthorn Drive, Sagamore Hills, OH 44067 (US). (74) Agent: O'CONNOR, Thomas, E., Jr.; Arter & Hadden, 10 West Broad Street, Columbus, OH 43215 (US).</p>		<p>(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, ARIPO patent (KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).</p> <p>Published <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i></p>

(54) Title: SYSTEM FOR CONTINUOUS MONITORING OF PHYSICAL ACTIVITY DURING UNRESTRICTED MOVEMENT

(57) Abstract

A movement skills assessment system (10) without a confining field includes a wireless position tracker (14, 16) coupled to a personal computer (22) and viewing monitor (28) for the purpose of quantifying the ability of a player to move over sport specific distances and directions. The monitor displays a computer-generated virtual space (30) which is a graphic representation of a defined physical space in which the player moves and the current position of the player. Interactive software displays a target destination distinct from the current position of the player. The player moves as rapidly as possible to the target destination. As the movement sequence is repeated, performance-related parameters including quickness, heart rate activity as related to physical activity, consistency of maintaining a set position, and energy expenditure are measured. The system has applications in sports, commercial fitness and medical rehabilitation.



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AM	Armenia	GB	United Kingdom	MW	Malawi
AT	Austria	GE	Georgia	MX	Mexico
AU	Australia	GN	Guinea	NE	Niger
BB	Barbados	GR	Greece	NL	Netherlands
BE	Belgium	HU	Hungary	NO	Norway
BF	Burkina Faso	IE	Ireland	NZ	New Zealand
BG	Bulgaria	IT	Italy	PL	Poland
BJ	Benin	JP	Japan	PT	Portugal
BR	Brazil	KE	Kenya	RO	Romania
BY	Belarus	KG	Kyrgyzstan	RU	Russian Federation
CA	Canada	KP	Democratic People's Republic of Korea	SD	Sudan
CF	Central African Republic	KR	Republic of Korea	SE	Sweden
CG	Congo	KZ	Kazakhstan	SG	Singapore
CH	Switzerland	LI	Liechtenstein	SI	Slovenia
CI	Côte d'Ivoire	LK	Sri Lanka	SK	Slovakia
CM	Cameroon	LR	Liberia	SN	Senegal
CN	China	LT	Lithuania	SZ	Swaziland
CS	Czechoslovakia	LU	Luxembourg	TD	Chad
CZ	Czech Republic	LV	Latvia	TG	Togo
DE	Germany	MC	Monaco	TJ	Tajikistan
DK	Denmark	MD	Republic of Moldova	TT	Trinidad and Tobago
EE	Estonia	MG	Madagascar	UA	Ukraine
ES	Spain	ML	Mali	UG	Uganda
FI	Finland	MN	Mongolia	US	United States of America
FR	France	MR	Mauritania	UZ	Uzbekistan
GA	Gabon			VN	Viet Nam

SPECIFICATION

I. TITLE OF THE INVENTION

“System for Continuous Monitoring of Physical Activity During Unrestricted Movement”

II. IDENTIFICATION OF THE INVENTORS

Barry J. French
Kevin R. Ferguson

III. CROSS-REFERENCES

The present application is a continuation-in-part application of (parent) Application No. 08/554,564 filed 11/6/95, "Testing and Training System for Assessing Movement and Agility Skills Without A Confining Field," by Barry J. French and Kevin R. Ferguson.

IV. GOVERNMENT RIGHTS

The present application pertains to an invention that was not performed under any federally sponsored research and development.

V. BACKGROUND

A. Field of the Invention

The present invention relates to a system for assessing movement and agility skills and, in particular to a wireless position tracker for continuously tracking and determining player position during movement in a defined physical space through player interaction with tasks displayed in a computer generated, specially translated

virtual space for the quantification of the player's movement and agility skills based on time and distance traveled in the defined physical space.

B. The Related Art

Various instruments and systems have been proposed for assessing a person's ability to move rapidly in one direction in response to either planned or random visual or audio cueing. One such system is disclosed in French et al. United States Serial No. 07/984,337, filed on December 2, 1992, entitled "Interactive Video Testing and Training System", and assigned to the assignee of the present invention. Therein, a floor is provided with a plurality of discretely positioned force measuring platforms. A computer controlled video monitor displays a replica of the floor and audibly and visually prompts the user to move between platforms in a pseudo-random manner. The system assesses various performance parameters related to the user's movements by measuring critical changes in loading associated with reaction time, transit time, stability time and others. At the end of the protocol, the user is provided with information related to weight-bearing capabilities including a bilateral comparison of left-right, forward-backward movement skills. Such a system provides valuable insight into user's movement abilities in a motivating, interactive environment.

Sensing islands or intercept positions in the form of digital switches or analog sensors that respond to hand or foot contact when the player arrives at a designated location have been proposed for providing a variety of movement paths for the user as disclosed in United States Patent No. 4,627,620 to Yang. The measurement of transit speeds has also been proposed using discrete optical light paths which are broken at the designated locations as disclosed in United States Patent No. 4,645,458 to

Williams. However the inability to track the player's movement path continuously inhibits the development of truly interactive games and simulations. In these configurations, the actual position of the player between positions is unknown inasmuch as only the start and finish positions are determined. Most importantly, the requirement that the player move to designated locations is artificial and detracts from actual game simulation in that an athlete rarely undertakes such action, rather the athlete moves to a visually determined interception path for the particular sports purpose.

For valid testing of sports specific skills, many experts consider that, in addition to unplanned cueing, it is important that the distances and directions traveled by the player be representative of actual game play. It is thus desirable to have the capability to measure transit speeds over varying vector distances and directions such that the results can be of significant value to the coach, athletic trainer, athlete and clinician. It is also important to detect bilateral asymmetries in movement and agility so as to enable a clinician or coach to develop and assess the value of remedial training or rehabilitation programs. For example, a rehabilitating tennis player may move less effectively to the right than to the left due to a left knee injury, i.e. the "push off" leg. A quantitative awareness of this deficiency would assist the player in developing compensating playing strategies, as well as the clinician in developing an effective rehabilitation program.

In actual competition, a player does not move to a fixed location, rather the player moves to an intercept position determined visually for the purpose of either contacting a ball, making a tackle or like athletic movement. Under such conditions, it

Explore Litigation Insights

Docket Alarm provides insights to develop a more informed litigation strategy and the peace of mind of knowing you're on top of things.

Real-Time Litigation Alerts



Keep your litigation team up-to-date with **real-time alerts** and advanced team management tools built for the enterprise, all while greatly reducing PACER spend.

Our comprehensive service means we can handle Federal, State, and Administrative courts across the country.

Advanced Docket Research



With over 230 million records, Docket Alarm's cloud-native docket research platform finds what other services can't. Coverage includes Federal, State, plus PTAB, TTAB, ITC and NLRB decisions, all in one place.

Identify arguments that have been successful in the past with full text, pinpoint searching. Link to case law cited within any court document via Fastcase.

Analytics At Your Fingertips



Learn what happened the last time a particular judge, opposing counsel or company faced cases similar to yours.

Advanced out-of-the-box PTAB and TTAB analytics are always at your fingertips.

API

Docket Alarm offers a powerful API (application programming interface) to developers that want to integrate case filings into their apps.

LAW FIRMS

Build custom dashboards for your attorneys and clients with live data direct from the court.

Automate many repetitive legal tasks like conflict checks, document management, and marketing.

FINANCIAL INSTITUTIONS

Litigation and bankruptcy checks for companies and debtors.

E-DISCOVERY AND LEGAL VENDORS

Sync your system to PACER to automate legal marketing.